

## 270.305 - Energy Resources in the Modern World – Fall 2011

This in-depth survey will inform students on the non-renewable and renewable energy resources of the world and the future prospects. Topics include petroleum, natural gas, coal, nuclear, hydroelectric, geothermal, solar, wind, biomass and ocean energy. Global production, distribution, usage and impacts of these resources will be discussed. 3-credits. Prerequisite: 270.103, 270.107 or 270.220. Instructor: Prof. Linda Hinnov, [hinnov@jhu.edu](mailto:hinnov@jhu.edu). Office hours: Mon., Weds., Fri. 3-4 pm, 227 Olin Hall. Access **Blackboard** at <http://blackboard.jhu.edu>.

Meetings: Mondays, Wednesdays, Fridays, 1:30-2:20 pm, Room 305, Olin Hall.

Requirements: 4 homeworks (50%), 2 hour-long exams (50%).

Readings, Videos: Reading and video assignments posted on **Blackboard**

Ethics: Consult [http://www.jhu.edu/design/oliver/academic\\_manual/ethics.html](http://www.jhu.edu/design/oliver/academic_manual/ethics.html) for course policy.

Grading: For each homework and exam, a score of 100% will be assigned to the grade constituting the 90<sup>th</sup> percentile. All grades for that exam will be determined on an absolute scale based on this 100%, as follows:

SCORE	GRADE
92 – 100%	A
90 – 91%	A-
87 – 89%	B+
82 – 86%	B
80 – 81%	B-
77 – 79%	C+
72 – 76%	C
70 – 71%	C-
67 – 69%	D+
60 – 66%	D
65 – 60%	D-
Below 60%	F

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### **PART 1: NON-RENEWABLE ENERGY RESOURCES**

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#### **WEEK 1: ENERGY IN SOCIETY (Aug. 29 – Sept. 2)**

1. Meeting 1 – Brief history of energy (Mon. Aug. 29)
2. Meeting 2 – Defining energy, world energy production (Weds. Aug. 31)
3. Meeting 3 – World energy consumption (Fri. Sept. 2)

Readings:

- What You Need to Know about Energy [National Research Council]
- Energy Explained: (Basics) [US Energy Information Administration]

Hand out Homework # 1 (Due Friday, September 16)

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#### **WEEK 2: PETROLEUM – PART 1**

Mon. Sept. 5 – LABOR DAY- no class

4. Meeting 4 – Geology of oil: formation, migration, traps (Weds. Sept. 7)
5. Meeting 5 – Global distribution of petroleum (Fri. Sept. 9)

Reading:

- Chapter 1–Introduction to Petroleum Geology [K. Bjørlykke, Petroleum Geoscience 2011]

Videos:

- [The Prize: Episodes 1 — 4 \[BBC-PBS, D. Yergin, 1992\]](#)
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### **WEEK 3: PETROLEUM – PART 2**

6. Meeting 6 – Exploration (Mon. Sept. 12)
7. Meeting 7 – Production (Wed. Sept. 14)
8. Meeting 8 – Hydrocarbon chemistry: petroleum products (Fri. Sept. 16)

#### Reading:

- [The Story of Oil and Natural Gas \[American Petroleum Institute\]](#)
- [Energy in a High Tech World: Oil Refining – A Closer Look \[AAAS, Science Netlinks\]](#)
- [Discovery Timeline – Petroleum products \[APPE\]](#)

#### Videos:

- [The Prize: Episodes 5 — 8 \[BBC-PBS, D. Yergin, 1992\]](#)

**\*\*Hand in Homework # 1 -- Friday, September 16**

**Hand out Homework # 2 (Due Tuesday, October 11)**

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### **WEEK 4: NATURAL GAS**

9. Meeting 9 – Geology of natural gas (Mon. Sept. 19)
10. Meeting 10 – Geology of natural gas – concluded (Weds. Sept. 21)
11. Meeting 11 – Natural gas production; shale gas (Fri. Sept. 23)

#### Reading:

- [Modern Shale Gas Development in the US - A Primer](#)

#### Video:

- [Horizontal Well Drilling Animation](#)
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### **WEEK 5: NATURAL GAS – CONCLUDED; COAL**

12. Meeting 11 – Future resources, gas products – concluded (Mon. Sept. 26)
13. Meeting 12 – Geology of coal; mining; electricity generation (Weds. Sept. 28)
14. Meeting 12 – Geology of coal; mining; electricity generation – concluded (Fri. Sept. 30)

#### Reading:

- [Coal Resources of the World \[S. Korpela, 2008\]](#)

#### Video:

- [Animated Coal Plant Tour](#)
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### **WEEK 6: COAL**

15. Meeting 13 – Advanced coal processing; coal products (Mon. Oct. 3)
16. Meeting 13 – Advanced coal processing; coal products - concluded (Weds. Oct. 5)
17. Meeting 14 – Fossil fuel disasters (Fri. Oct. 7)

#### Video:

- [Deepwater Horizon disaster](#)
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### **WEEK 7: REVIEW AND EXAM 1**

**Mon. Oct. 10 – BREAK DAY**

18. Meeting 14 – Fossil fuel disasters – concluded (Tues. Oct. 11)
19. Review for Exam 1 (Weds. Oct. 12)
20. **Exam 1 (Fri. Oct. 14)**

**\*\*Hand in Homework # 2 -- Tuesday, October 11**

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## **PART 2: RENEWABLE ENERGY RESOURCES**

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### **WEEK 8: NUCLEAR POWER**

- 21. Meeting 15 – Introduction to nuclear fission (Mon. Oct. 17)
- 22. Meeting 16 – Uranium reserves; nuclear fuel cycle; radioactive waste (Weds. Oct. 19)
- 23. Meeting 17 – Nuclear fusion (Fri. Oct. 21)

#### Reading:

- Uranium: Its Impact on the National and Global Energy Mix (Finch, 1997)
- Yucca Mountain Final (Los Alamos National Laboratory Fact Sheet, 2011)

#### Videos:

- Natural uranium, its ores and DUF6
  - Nuclear Power Plant tutorial
  - Ontario Power Generation by CANDU reactor
  - Introduction to Fusion
  - Fusion is Energy's Future
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### **WEEK 9: WIND AND SOLAR POWER**

- 24. Meeting 18 – Wind Power (Mon. Oct. 24)
- 25. Meeting 19 – Solar Thermal Energy (Weds. Oct. 26)
- 26. Meeting 20 – Solar Photovoltaics (Fri. Oct. 28)

#### Online readings/videos:

- Winds of Change (Online Documentary) [IEEE Future Directions, 2011]
- Wind Power Animation [US DOE]
- Solar Energy Basics (short video):
- Concentrating Solar Power (short video)
- Status of CSP development (60 min. video)
- Gemasolar Thermosolar Plant (short video)
- Solar Photovoltaic Technology (short video):

Hand out Homework # 3 (Due Friday, November 18)

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### **WEEK 10: HYDROELECTRIC, OCEAN, GEOTHERMAL POWER**

- 27. Meeting 21 – Hydropower; dams (Mon. Oct. 31)
- 28. Meeting 22 – Ocean power (Weds. Nov. 2)
- 29. Meeting 23 – Geothermal power (Fri. Nov. 4)

#### Online readings/videos:

- Hydropower facts
  - Itaipu Dam, Brazil/Paraguay
  - Three Gorges Dam, China
  - Ocean tidal, current, wave and thermal energy
  - Geothermal energy, heat pumps
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### **WEEK 11: BIOFUELS; FUEL CELLS**

- 30. Meeting 24 – Biofuels, biopower, bioproducts (Mon. Nov. 7)
- 31. Meeting 25 – Advanced biofuels, impacts and emissions (Weds. Nov. 9)
- 32. Meeting 26 – Fuel cells (Fri. Nov. 11)

#### Online readings/videos:

- Biofuels
  - Fuel cells
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## **PART 3: FUTURE OF ENERGY RESOURCES**

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**WEEK 12: ENERGY EFFICIENCY**

33. Meeting 27 – Daylight; buildings; appliances (Mon. Nov. 14)  
34. Meeting 27 – Daylight; buildings; appliances – concluded (Weds. Nov. 16)  
35. Meeting 28 – Smart grid, transportation (Fri. Nov. 18)

Online readings/videos:

- Smart grid
- Passive homes
- Zero energy homes
- High efficiency vehicles

\*\*Hand in Homework # 3 -- Friday, November 11

Hand out Homework # 4 (Due Friday, December 2)

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**WEEK 13: SUSTAINABLE ENERGY**

36. Meeting 29 – Sustainable renewable energy (Mon. Nov. 21)  
Weds. Nov. 23 – THANKSGIVING  
Fri. Nov. 25 – THANKSGIVING

Online readings/videos:

- Earth: The Operator's Manual video [Richard Alley]
  - Energy Literacy lecture [Saul Griffith]
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**WEEK 14: PEAK OIL; PEAK ANYTHING**

37. Meeting 30 – Estimating peak oil (Mon. Nov. 28)  
38. Review for final exam (Weds. Nov. 30)  
39. Final exam (Fri. Dec. 2)

No Readings/videos.

\*\*Hand in Homework # 4 -- December 2